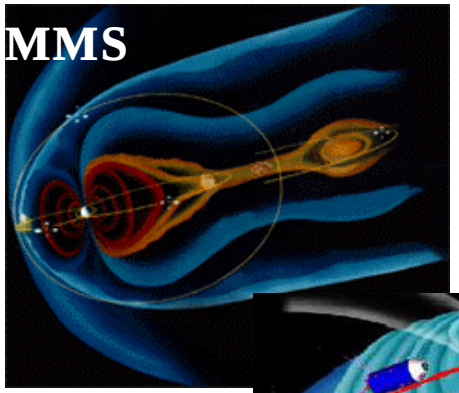
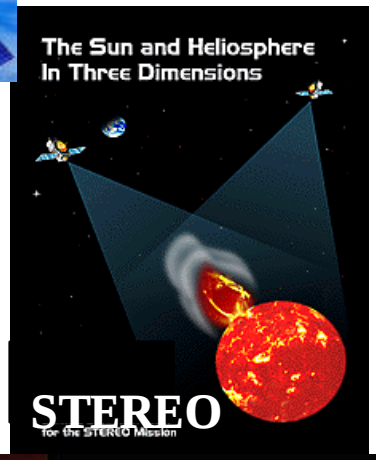
Solar Terrestrial Probes
Mission Overview

Determine basic structure and understand energy balance of mesosphere, lower thermosphere, ionosphere

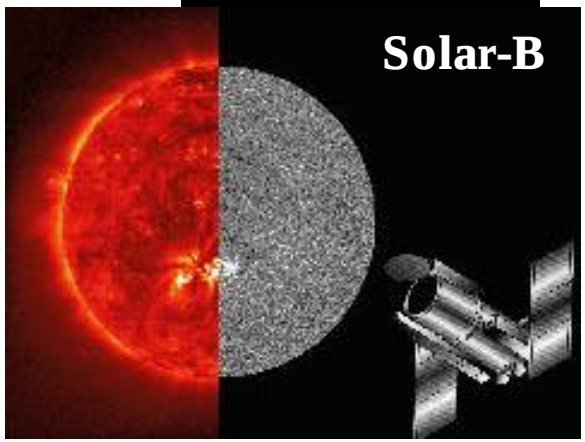


Understand fundamental plasma processes of reconnection, acceleration and turbulence

Understand origin, evolution, and propagation of CME's

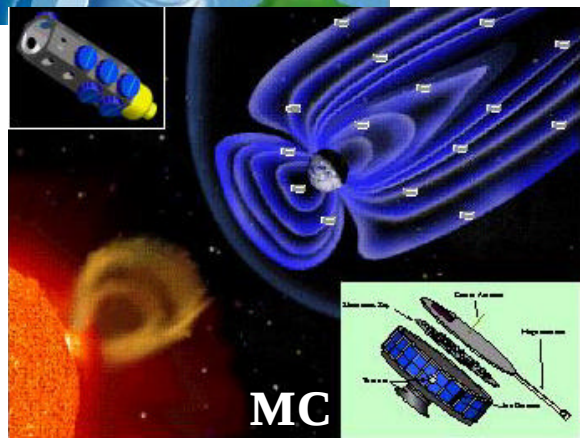


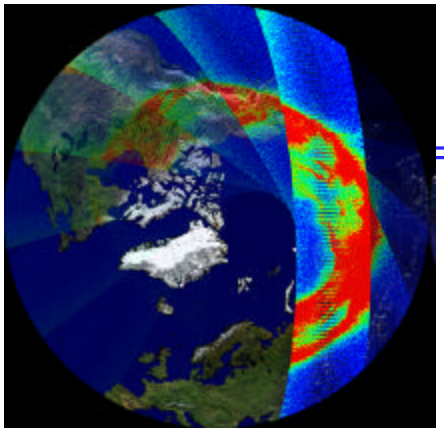
Understand plasma interactions with the atmosphere



Understand creation and destruction of solar magnetic field

Understand processes that control the dynamic state and energy flow of the magnetosphere





TIMED Mission Summary

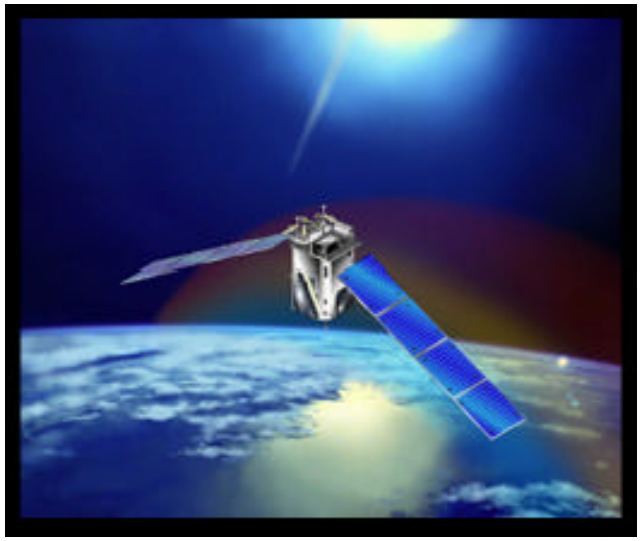
Launched December 2001

Science Measurement Strategy & Objective:
The primary science objective of the TIMED mission is to understand the **energy transfer into and out of the Mesosphere and Lower Thermosphere/Ionosphere (MLTI) region** of the Earth's atmosphere (energetics), as well as the **basic structure** (i.e., pressure, temperature, and winds) that results from the energy transfer into the region (dynamics).

Located between approximately 40-110 miles (60-180 kilometers) above the Earth's surface, the MLTI region is sensitive to external influences from the sun above and atmospheric layers below it. Its chemical and thermal balance can change rapidly due to naturally-occurring and/or human-induced changes to the energy contained within this region.

TIMED Watched Earth's Response to Strong Solar Storms in April 2002

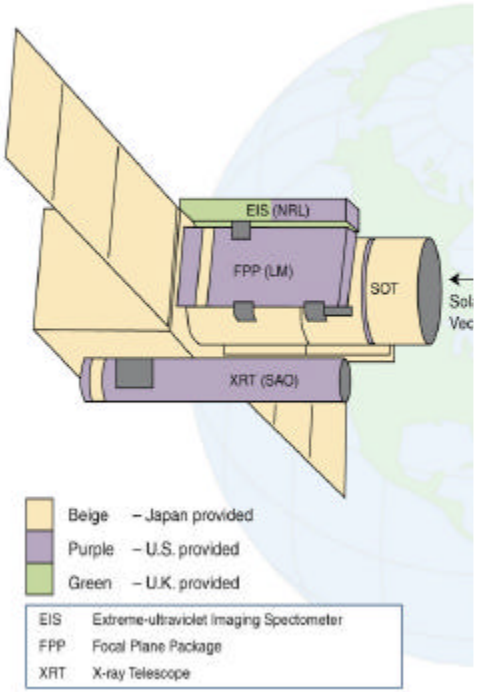
NASA's TIMED (Thermosphere, Ionosphere, Mesosphere, Energetics and Dynamics) spacecraft observed the response of Earth's upper atmosphere to a series of strong solar storms that occurred in late April 2002, providing important new information on the final link in the Sun-Earth Connection chain geared toward explaining the physical processes connecting the sun and Earth.



Project Description: Solar-B

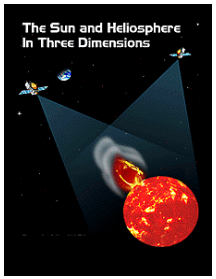
Mission Objective: 3 year mission to measure the sun's magnetic field and ultraviolet/ X-ray radiation, and use the data to increase the understanding of the sources of solar variability.

Organizations: Mission Lead: ISAS - The Japanese Institute of Space Science. Partners: PPARC-The Particle Physics and Astronomy Research Council of UK; NASA/GSFC, MSFC. Principal Investigators: Lockheed Martin, Smithsonian Astrophysical Observatory, NRL. ISAS to provide the spacecraft and the M-V launch vehicle.



Description: Single Sun-synchronous LEO spacecraft to study the sun. (600-km circular orbit, 6 a.m./6 p.m. crossing)

Launch Schedule: September 2005, from Kagoshima, Japan.



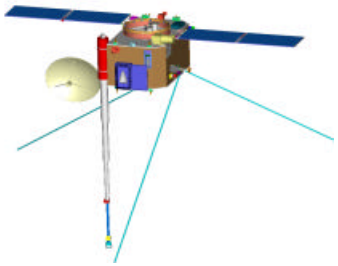
Project Description: Solar Terrestrial Relations Observatory (STEREO)

Mission Objectives: **2-year mission to measure the causes and mechanisms of CME initiation and characterization of their propagation through the heliosphere.**

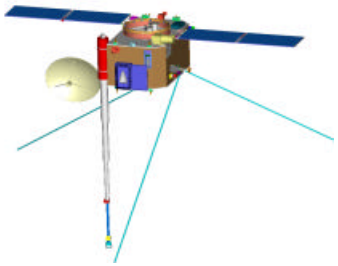
Organizations: NASA/ GSFC, JHU/APL, Naval Research Laboratory, University of California at Berkeley, University of New Hampshire, University of Minnesota, Observatoire de Paris

Mission Description: **Two Functionally Identical Spacecraft in Heliocentric Orbits at 1 AU (22°/yr Drift From Earth Orbit Leading/ Lagging Configuration)**

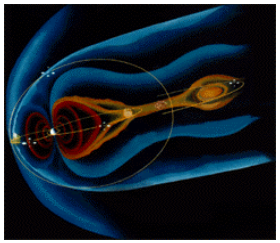
Each Observatory



Volume:	1.2 w x 2.0 l x 1.5 h meters
Mass:	468 kg (dry mass)
Power:	453 W (EOL)



Launch: To be launched from KSC on a Delta 2925-10L in **November 2005**



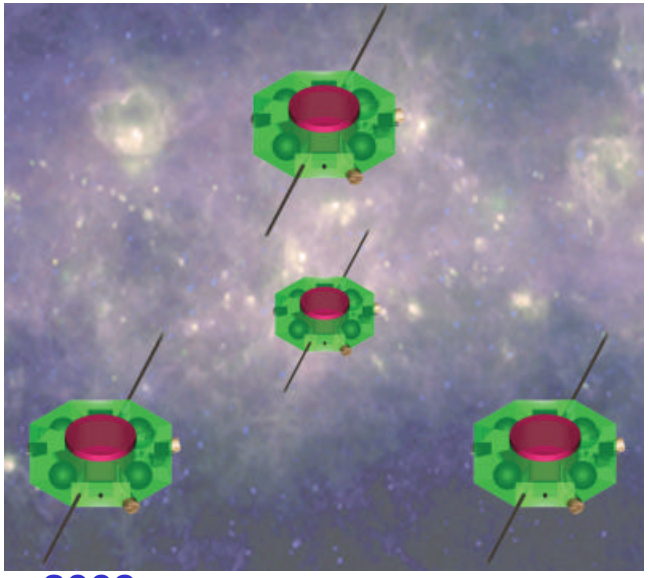
Project Description: Magnetospheric MultiScale (MMS)

Mission Objectives: **2-yr mission to explore and understand the fundamental plasma physics processes of reconnection, particle acceleration, and turbulence on the micro- and mesoscale in the Earth's magnetosphere.**

Organizations: GSFC: Project Management, Systems Engineering, Mission Ops
TBD: Instrument Science Suite Team Principal Investigator
TBD: RSDO Vender
TBD: Ranging System

Mission Description:

- 4 spin-stabilized spacecrafts
- 4 suites of identical instruments: electric field, energetic particles, hot plasma & magnetometer
- Inter-spacecraft ranging system
- Tetrahedron constellation
- 4 mission orbit phases (elliptical: perigee 1.2 R_E)
  - Phase 1 apogee 12 R_E 9 months
  - Phase 2 apogee 20-30 R_E 3 months
  - Phase 3 Lunar assist maneuver
  - Phase 4 apogee 40 R_E 11 months (perigee 10 R_E)
- Observatory resources (conceptual)
  - Mass ~300kg
  - Power ~130W
  - Data rate ~2Gbit/day
  - Dimensions ~2m across flats ~0.9m high



Launch: To be launched from KSC on a Delta II (heavy) in **January 2009**
Web Site: stp.gsfc.nasa.gov

GEC Mission Summary

Science Measurement Strategy & Objective:

Systematic Multi-Point In-Situ Plasma/Neutral Atmospheric Measurements, at Low Altitudes to **Understand the Temporal and Spatial Scales that Underlie the Coupling Between the Earth's Ionosphere, Thermosphere, and Magnetosphere.**

Mission Description:

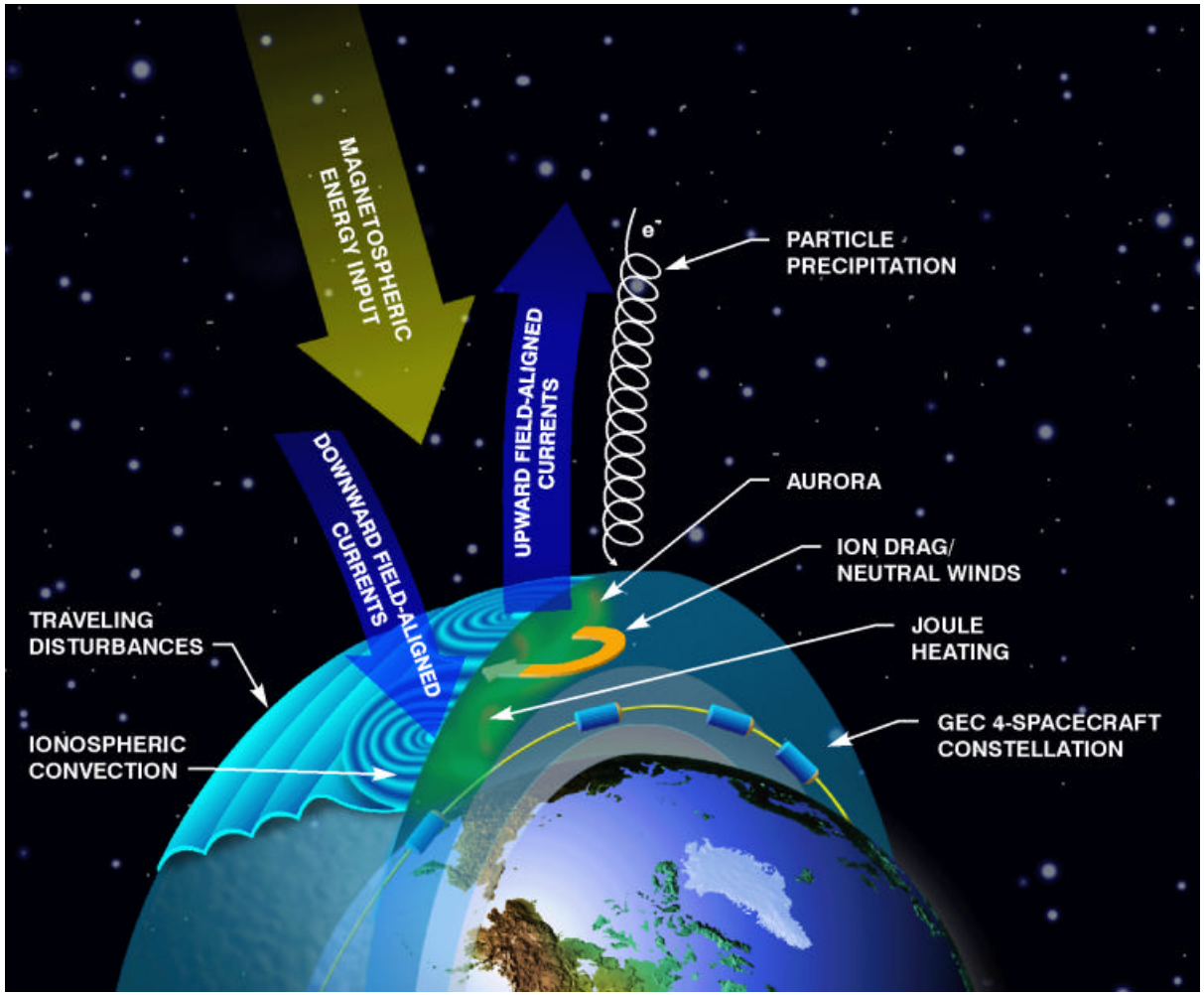
A Constellation of Four Spacecraft, variably spaced in a "Pearls-On-A-String" Configuration,

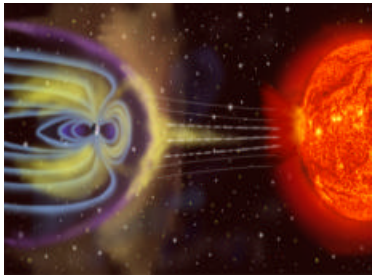
Each Carrying Identical Sets of Eight Instruments (Electric & Magnetic Field, Energetic Particle, Electron/Ion Densities, Ion & Neutral Composition with Corresponding Velocity Measurements).

Launch in September 2009.

Orbit Parameters:

An Elliptical Parking Orbit of 185 x 2000 km; Inclined @ 83°.





Project Description: Magnetospheric Constellation (MC) Mission

Mission Objective: Systematic **multi-point measurements of the fundamental processes coupled with resolving system scales of the magneto-tail** to the solar wind. In particular, it will reveal the locations and extents of the instabilities that trigger the explosive release of solar wind energy, mass, and momentum stored within the magnetotail, how these entities are transported, and the means by which magnetotail phenomena are propagated between regions and to the auroral ionosphere.

Organizations: Solar Terrestrial Probes (STP) Program has authority for overall mission management. Currently in the pre-formulation phase.

Mission Description: The mission will utilize rapidly developing technologies to deploy a **"constellation" of nanospacecraft.** With resources of ~10–20 kg and 10 W apiece, 50–100 nanosatellites will be deployed in highly elliptical, equatorial orbits with common perigees of 3 Re and apogees distributed from 7–40 Re , yielding mean interspacecraft separation of ~1–2 R E. The primary science will be accomplished annually when the constellation sweeps through the magnetotail.

Launch: **September 2012** from CCAFS/KSC on a Delta II Class Launch Vehicle

SEC Missions